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THE ACCESS DATABASE FOR THE ZLETOVO MINE, REPUBLIC OF MACEDONIA

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ABSTRACT

Organization of the Access database of the Zletovo lead-zinc deposit Eastern Macedonia represents the first attempt of this paper authors to synthesize geological exploration data of this ore bearing locality in one professional database available for the interested parties. Ours experience in organization of similar databases for other metal deposits such are Bucim, Borov Dol, Kadiica, Sasa etc., gave us the necessary knowledge and experience to construct quality Access database for the Zletovo deposit. The Zletovo has been classified as a sub-volcanic hydrothermal lead-zinc ore deposit. The main ore minerals are galena and sphalerite. They occur in very distinct structures, microstructures and textures, which often enclose sulphosalt mineral phases. The most common of them being bournonite, boulangerite, proustite and luzonite. This paper focuses on efforts we made to organize Microsoft Access database with the most representative data for this particular deposit in the Republic of Macedonia. At the very beginning, with the software package "Microsoft Access" we have organized database with information of the most important geological, metallogenic and economic features of the deposit. The database was adapted for simple and sophisticated querying of particular deposit features and allows edition of reports and a geographic display of the queried information. Major data that completed database for the Zletovo deposit are: the deposit belongs to the famous Kratovo-Zletovo ore district, it is at the industrial production stage under exploitation concession of the Bulmak company with proved reserves of 9.8 Mt of lead and zinc with 7.59% Pb and 2.44% Zn, mineralization/rocks part of the database showed the mineralization age (relative 16.4-13.6 Ma; absolute 16 Ma) and host rock age (relative 28.4 - 23.03 Ma; absolute 27 Ma, K/Ar method) with main host lithology consisting of pyroclastite and pyroclastic rocks, ignimbrite, wellded tuff, andesite and dacite, economic parameters were dominated by the fact that of proved mineral reserves of 9.8 Mt (as of 2007 and combined lead-zinc metal potential of 704 700 t ; 502 200 t Pb and 202 500 t Zn), also on the comments section we stressed out that its metallogeny is related to Tertiary calk-alkaline magmatism (predominantly Miocene) where mineralization is in dacite ignimbrite comlex and volcanosedimentary suite while ore bodies are in veins.

Keywords: Zletovo lead-zinc deposit, Access database, reserves, economy.

INTRODUCTION

The Zletovo lead-zinc deposit is located in the eastern parts of the Republic of Macedonia. It formed during hydrothermal activity that was intimately associated with Tertiary volcanism along an active continental margin [1], [2], [3], [4], [5]. The major rock types in the area are andesite, dacite, dacitic ignimbrite and volcanic tuff [2], [3], [4], [5], [6]. Dacitic ignimbrite is the most common volcanic unit. Pb-Zn mineralization at Zletovo is spatially and genetically related to fracture zones that trend NW, NNW and ENE. These fractures appear to have served as the main conduits and depositional sites for hydrothermal fluids. Mineralization filled joints and brecciated zones, and has replaced wall rocks. The orebodies comprise numerous veins and associated stockwork mineralization in areas of altered wall rocks. Most of the veins have a strike length of more than 1 km. Ore vein No 10 is exceptional because it can be followed for up to 10 km along strike. Vein thickness ranges from a few cm up to 2 m. The veins generally dip from 40° to near-vertical, averaging about 60°. The veins have been intersected at depths of up to 500 m. The morphologies and compositions of the ore veins from Zletovo are generally similar. We use ore vein No 10 as the type example. The central vein consists primarily of massive sulphide ore and contains clay-altered clasts of volcanic rocks. Sulfides have impregnated the intensely clay-altered wall rocks adjacent to the veins. Siderite bands occur near the vein walls. The ore mineral association comprises galena as the principal ore mineral together with sphalerite and subordinate pyrite, siderite and chalcopyrite, and rare pyrrhotite, marcasite, and magnetite. Minor occurrences of U-mineralization (pitchblende) have also been discovered. Detailed information about the mineral parageneses and geochemical features of the major minerals in ore veins is provided in [2], [3], [4], [5], [6]. The veins typically contain large clasts or screens of altered dacitic and andesitic wallrocks. The altered clasts are weakly mineralized or barren.

Up to date, in the Republic of Macedonia there weren't professional databases that should be in accordance to the European directives, although there is an initiative in ours Ministry of Economy that such database(s) should be prepared and included in similar modern European databases (ex. BRGM Mineral database). Here we were aiming to organize databases with an information about some of the most representative Kadiica deposit feautures, regarding natural issues. Bearing in mind that the Kadiica deposit has a long history of exploration, we knew that building aforementioned database is not an easy task to fulfill. We had to systematize data from exploration longer than two decades. Organization of the Access database was carried out under several main topics, which are in accordance with the GIS related mineral databases principles given elsewhere [7], [8], [9], [10], [11], [12], [13].

DISCUSSION

The particular mineral database itself was structured under the following main topics:

General information where has been enclosed information about the mining company, status, latitude/longitude, ore district name, comments etc. (Figure 1). For example on our sample of the Zletovo deposit we gave an accent that it is an operating mine/deposit with certain potentials in regards to lead-zinc and some other associated metals (Ag, Cd, ...).

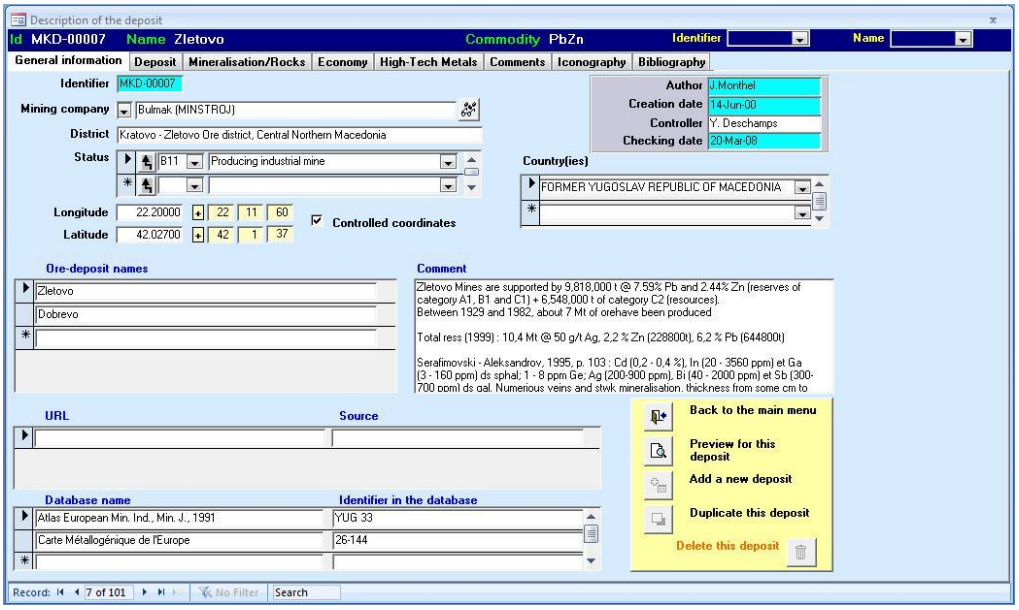

Fig. 1. General information datasheet of the database

That information was followed by detailed coordinates and name of the exploration concession owner, as well as familiar names used by locals for the locality and short general comments.

Deposit features sheet is organized in a manner that should be given details about the parameters: deposit type, main morphology and secondary morphology (Figure 2). On our example deposit, Zletovo, we have entered data about the deposit's combined type where we have pointed out its low-sulphidation epithermal to mesothermal polymetallic type sometimes followed by Ag-veins that is complemented by information about the secondary morphologies.

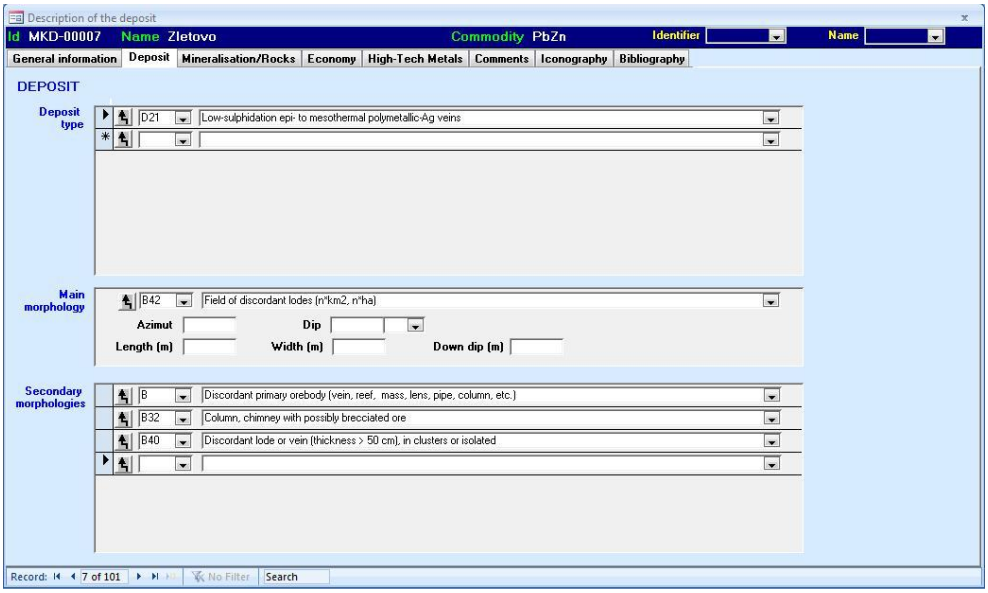

Fig. 2. Deposit features datasheet of the database

Mineralization/Rocks data sheet usually should contain data about age (supposed and absolute), ore mineralogy, gangue mineralogy, hydrothermal alteration, host rock (age supposed/absolute, host rock formation, name and lithology). All of them being grouped into separate main window (Figure 3).

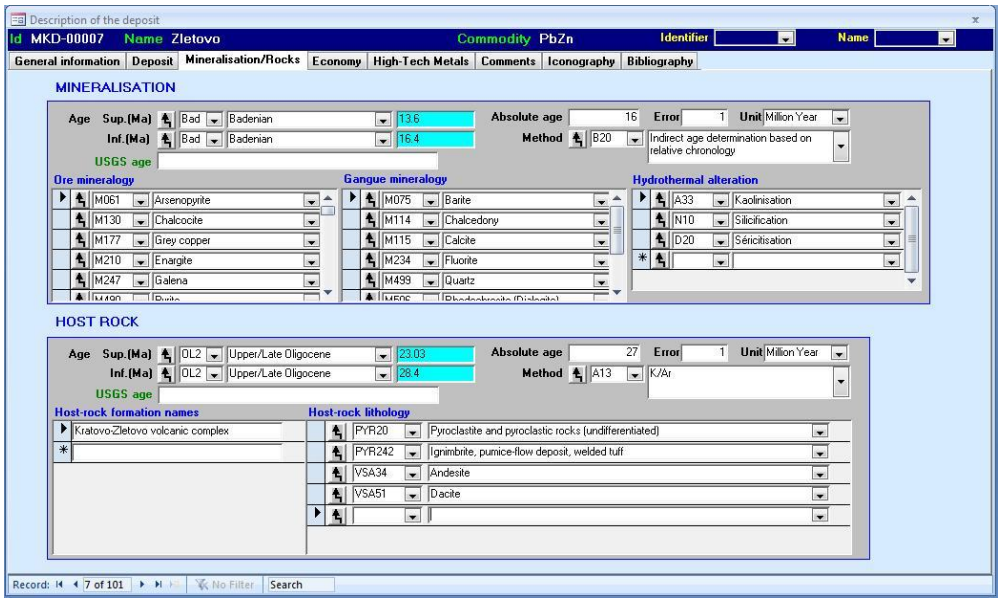

Fig. 3. Mineralization-rocks information datasheet of the database

This part of the database was filled with a significant amount of data regarding the mineralization age (relative 16.4-13.6 Ma; absolute 16 Ma), ore mineralogy (galena, sphalerite, arsenopyrite, chalcopyrite, enargite, pyrite, chalcocite, etc.), gangue mineralogy (biotite, chalcedony, calcite, fluorite, quartz etc.) and diverse hydrothermal alterations (kaolinization, silicification and sericitization). After that the database was enriched with an information about the host rock age (relative 28.4 - 23.03 Ma; absolute 27 Ma, K/Ar method) and host rock lithology (mainly pyroclastics, ignimbrite, welded tuff, andesite and dacite, etc.).

Economy data sheet was planned to provide an information about ore type, grade unit, former production, average grade of production, years of exploitation, reserves, average grade, type of reserves, resources, average grade of resources, type of resources organized in windows named exploitation type, main commodity and commodity (Figure 4).

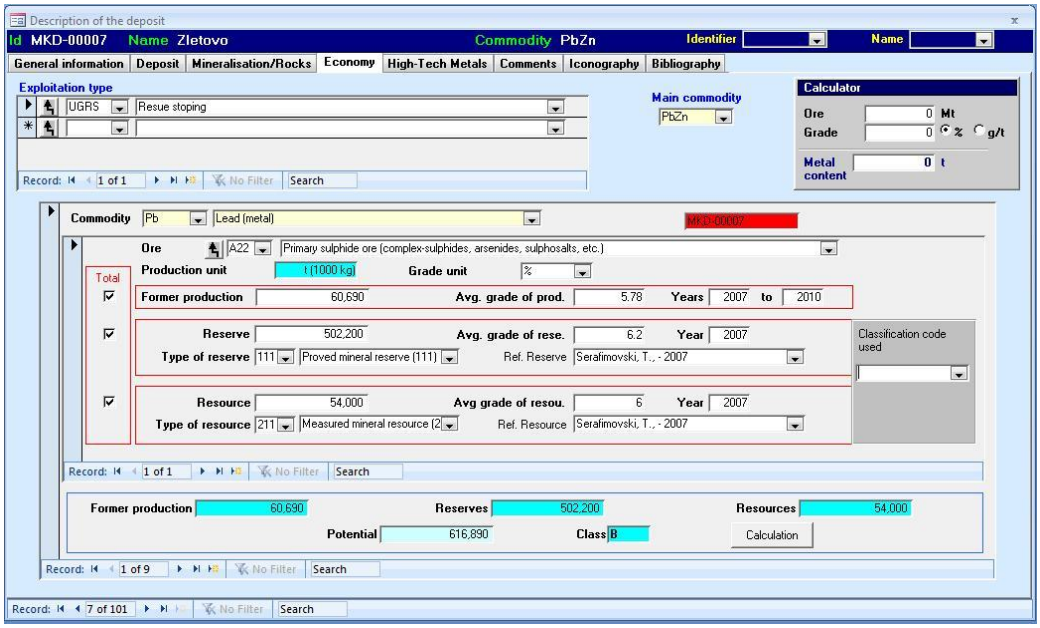

Fig. 4. Economy information datasheet of the database

So, here for the Zletovo mine/deposit, was given information about the operating status of exploitation type where the main commodities, lead and zinc, are represented by primary sulfide ore (complex sulfides, sulphosalts etc.). Also, reserves has been quoted as 60 t of former production, proved mineral reserves of 9.8 Mt (as of 2007 with 6.2% Pb and zinc with 2.5% Zn) followed by data about additional commodities (Ag, Cd) given as separate records within this datasheet (metal production, not the raw ore).

High-Tech Metals data sheet was divided into two different windows, which have been established in order to characterize (i) Potential of specific commodities or capacities (ii) where the anthropogenic products are processed. To characterize High-Tech metals, user has to enter a commodity (ex. Re, Se, Ga…), and then he will be able to give information about host minerals (e.g. molybdenite), grades (i.e. minimum, maximum and average grade) and abundance of host minerals in the ore. The right window give information about processing site(s) (e.g. concentrator, mill, smelter…). Due to nature of exploitation of the Zletovo deposit (still major metals /Pb and Zn/ are the only ones obtained from the deposit), we haven't entered any additional data regarding this information sheet of the database.

Comments sheet, which is composed of two windows where it is possible to write free texts describing details about geology and/or details about economy of a particular deposit gives a fine opportunity to describe particular deposit in more details (Figure 5). Here we have entered extensive free text data about the detailed geological and mineralization features of the deposit, not mentioned elsewhere in the database (Figure 5).

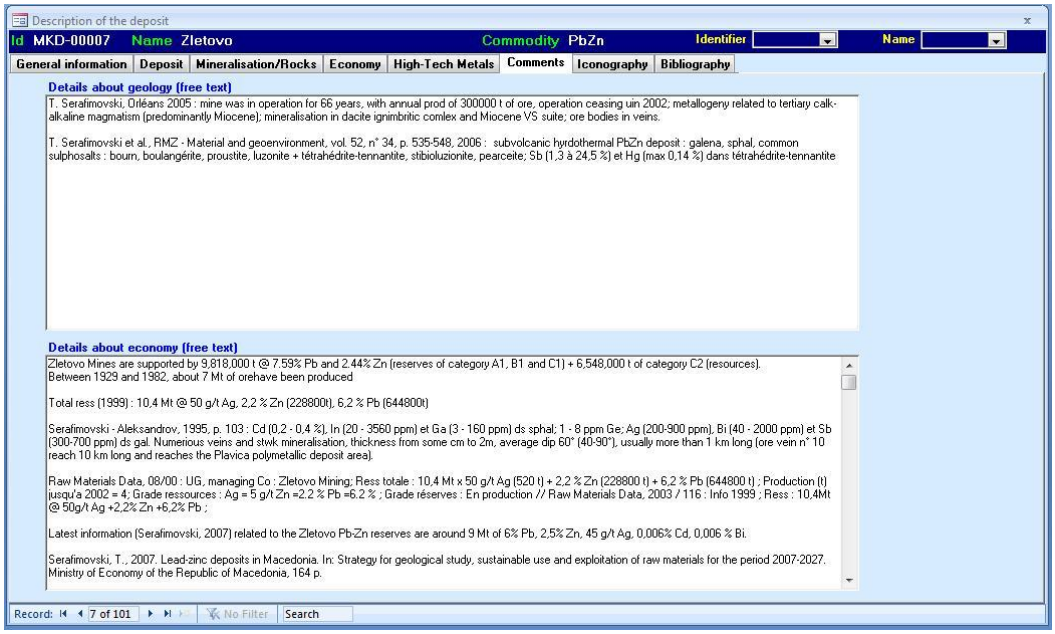

Fig. 5. Comments information datasheet of the database

Here in the upper window we accented that the ore deposit Zletovo is relatively old mine with its specific geology. Also, here we stressed out that its metallogeny is related to tertiary calk-alkaline magmatism (predominantly Miocene) where mineralisation is in relation to the host lithology consisting of pyroclastite and pyroclastic rocks, ignimbrite, wellded tuff, andesite and dacite. In the lower window were given some details on the economical aspect of the mine such were total reserves, excavated and remaining ones. The economic parameters were dominated by the fact that proved mineral reserves of 9.8 Mt are having lead and zinc concentrations of 7.59% Pb and 2.44% Zn.

Iconography sheet has been elaborated in order to attach images with a deposit. The first step being definition of paths of the image directory and the image viewer (e.g. Photo Editor, Windows picture viewer, Picasa..) by clicking on "Configuration" button.

Bibliography data sheet for a particular deposits was intended to give an overview of geological bibliography (references relating to the geology of the deposit) and economical bibliography (references relating to economic data of the deposit) as can be seen at Figure 6.

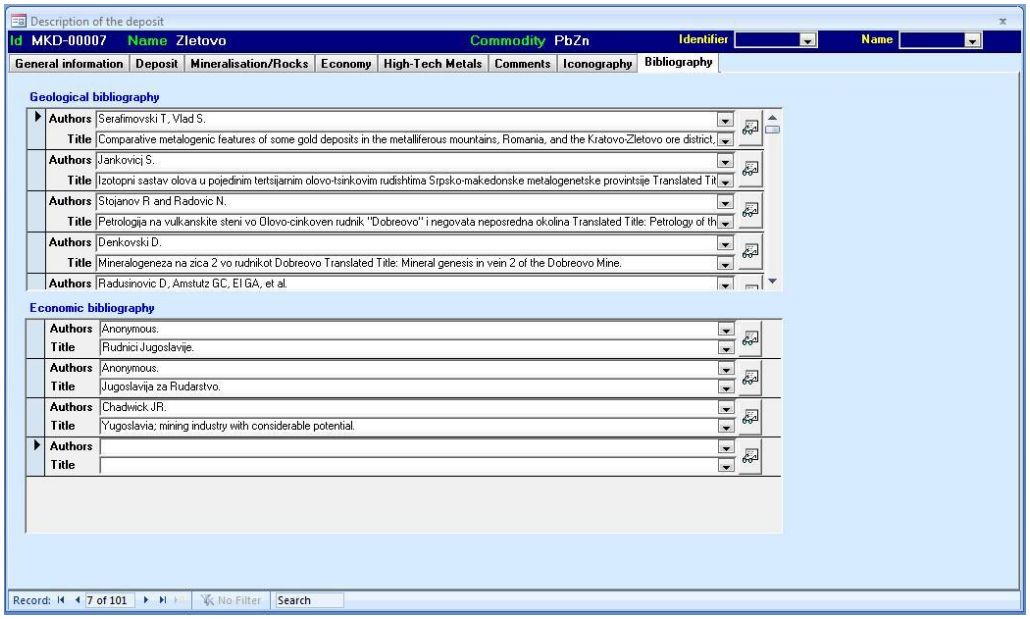

Fig. 6. Bibliography information datasheet of the database

For the Zletovo mine/deposit, we made significant input in regards to both types of bibliography, geological and economical ones. All the known and commonly used references to this particular deposit have been covered in this data sheet.

CONCLUSION

For the purposes of building the Access database for the Zletovo lead-zinc mine/deposit we kept in mind its major accents in the qualitative-quantitative parameters and natural indicators in function to present and future valorization of metals that were subject to the establishment of the database, in accordance with professional mineral databases, as well as economic viability of the particular ore elements in the near future bearing in mind the complex and variable nature of market and prices of copper concentration given in the particular Access database. The major findings and accents were that the Zletovo mine is at the advanced stage of exploitation with certain lead-zinc potentials complemented by eventual by-products such are Ag, Cd, In etc. Certain parts of the database showed the mineralization age of 16 Ma with host rock age around 27 Ma (K/Ar method) where the main host lithology consists of pyroclastite and pyroclastic rocks, ignimbrite, wellded tuff, andesite and dacite. From the economic point of view were accented proved mineral reserves of 9.8 Mt (with 7.59% Pb and 2.44% Zn) while in the regards of metallogeny was stressed out that it is related to Tertiary calk-alkaline magmatism (predominantly Miocene).

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